

Remarks

- Claims 1-10 and 12-14 are pending.
Claims 1, 2, 4, 5, 9, 12 and 14 are amended.
Claims 6 and 8 are original.
Claims 3, 7, 10 and 13 are as previously presented.

Claims 1, 2 and 5 are amended to delete the phrase "blue-tinged red shade". Claim 2 is also amended to delete an inadvertent ")" from line 1.

Claim 4 is amended to number the structures appearing therein, support is found in the original claim. Claim 4 is also amended for clarity by inserting the word "reacting" into the line immediately following the first occurrence of structure (51a) and to insert at the end of the claim the phrase "resulting in a pigment which has a particle size of less than or equal to 0.1 μ m, has a transmission at 570-580 nm of less than 5% and a transmission at 615 nm of at least 80%". Support is found in claim 2 from which claim 4 depends.

Claim 4 is also amended to insert the word "water" between the words comprising and methanol in the phrase "mixture comprising methanol... " near the end of the claim. Support can be found in the working examples, for example, on page 17 lines 9-12 of the specification.

Claim 9 is amended to insert the phrase "to a transparent substrate or pigmenting a transparent substrate with said pigment" at the end of the last line. Support is found in the Specification in the bottom paragraph of page 10 and on page 11, lines 15-16.

Claims 12 and 14 are amended for clarity by deleting the phrase "produced with" and inserting in its stead the word "comprising". Support is inherent in the claim.

No new matter is added.

Claim Rejections

Claims 1-10 and 12-14 are rejected under 35 USC 103(a) as obvious over Rochat US 4,597,949 in view of Wallquist, US Pat 5,738,719.

Applicants respectfully traverse the rejections.

On page 4 of the present Action the examiner states that the particle size of the pigment is not a process limitation, there is nothing to differentiate the instant process from that of US 4,597,949 and that the limitation of a temperature below 30°C is encompassed by the cited patent's range of less than 80°C.

Applicants respectfully aver that, as explained below, the claims as instantly amended, in particular instantly amended claim 4, address the issues raised by the Examiner regarding Rochat US 4,597,949.

Applicants also respectfully disagree with the statement in paragraph 2, page 2 of the present Action that Applicants did not invent the method of the invention. Applicants respectfully maintain that important specific features of the method of claim 4 are lacking in the cited art and were invented by Applicants. While the general synthetic approach of the instant invention may be analogous to the cited art, the conditions of hydrolysis and precipitation are substantially different from Rochat and result in a very different pigment.

Instant claim 4, as amended, includes the limitation that the pigments provided by the inventive process has a particle size of less than or equal to 0.1µm, has a transmission at 570-580 nm of less than 5% and a transmission at 615 nm of at least 80%. These particular pigment characteristics are a direct result of the improvements of the instant process over the process of US 4,597,949 when preparing small particle size, transparent pigments. While the Examiner is certainly correct that it is known in the art to process pigment particles (e.g., by grinding or milling etc.) after isolation of the crude pigment to obtain specific size and other characteristics, the instant inventive steps pertain to processing that occurs prior to isolating the pigment. Obtaining pigments with a particle size of less than or equal to 0.1µm is difficult even with additional processing after pigment isolation. The inventive process provides such pigments without such additional processing.

Applicants disclose the processing step recited in claim 4 of discharging the reaction mixture into an aqueous mixture comprising acetic acid and methanol at temperatures below 30°C (see Example 1, -5°C and Example 4, <30°C) which leads to immediate precipitation and soft neutralization. It is this step, which has several features not contemplated in US 4,597,949, that allows for the direct isolation of the transparent, small particle size pigment of the invention.

First, US 4,597,949 does not disclose discharging the reaction mixture into the hydrolysis agent. For the most part, the disclosure of US 4,597,949 is quite general in describing the process of the hydrolysis step and in the Examples hydrolysis is always performed by slow addition of methanol followed by addition of either acetic acid at 65°C or a methanol/acetic acid mixture at 60°C.

Unfortunately, Applicants must acknowledge that in their previous response, Applicants agent erroneously wrote "US 4,597,949 teaches discharging the reaction mixture into a hydrolysis medium at temperatures below 80°C (column 7 / lines 29-31)". However, this is factually incorrect. US 4,597,949 never mentions or in any way suggests discharging the reaction mixture into a hydrolysis mixture.

Nonetheless, Applicants respectfully aver that even if US 4,597,949 had suggested that one would undertake hydrolysis by discharging the reaction mixture into a hydrolysis mixture, there remain other, highly significant features of the instant process that together produce the very small, highly transparent pigment particles of the invention. For example, there is

- no disclosure of a hydrolysis mixture comprising water, methanol and acetic acid,
- no examples wherein hydrolysis is accomplished by discharging the reaction mixture into the hydrolysis mixture,
- no examples of the instant pigments substituted on the phenyl rings by a substituted sulphur,
- no teaching regarding particle size, and
- no teaching regarding the use of temperatures below 30°C.

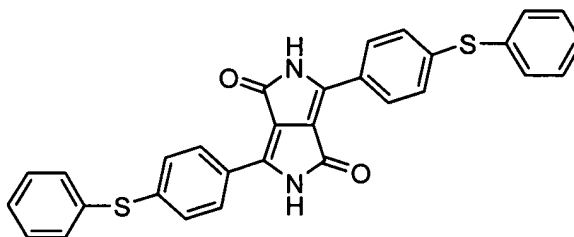
Applicants have therefore invented a process comprising a hydrolysis step which combines the features of (1) discharging the reaction mixture (2) into an aqueous mixture comprising acetic acid and methanol (3) at temperatures below 30°C which directly yields a DPP pigment with a particle size of less than or equal to 0.1µm, a transmission at 570-580 nm of less than 5% and a transmission at 615 nm of at least 80%.

In contrast, US 4,597,949 teaches that hydrolysis at temperatures below 80°C is sufficient to obtain a transparent colorant (column 7 / lines 29-31). Regarding the composition of the hydrolysis medium, US 4,597,949 teaches only that water, alcohols or acids can be used (column 6 / lines 16-19). In the Examples of US 4,597,949, hydrolysis is always performed by slow addition of methanol followed by acetic acid at 65°C (examples 1-46) or a methanol/acetic acid mixture at 60°C (examples 47 - 51). Hydrolysis therefore takes place slowly without preliminary precipitation leading to the isolation of pigment with particle sizes.

Thus, while the chemical reactions that produce the compounds which make up the pigments may be very similar in both the instant invention and US 4,597,949, the overall process, in particular the hydrolysis step just discussed, is quite different and have a large impact on the actual pigment particle formed. Applicants have included data to support this contention in the enclosed declaration.

Applicants respectfully ask the Examiner's indulgence in accepting the enclosed declaration under 132 signed by Roman Lenz even though submitted after final rejection. Applicants did not submit this declaration in their previous response because at that time Applicants had thought that the differences in the steps as performed might be sufficient to permit the claims to be found allowable. However, upon reflection, Applicants have decided that it would be reasonable for the Examiner to expect some proof that the method of the instant application did in fact produce a significant difference in the isolated pigment. Should the Examiner kindly enter and consider the declaration, Applicants believe that it will provide evidence that the pigments as instantly prepared are significantly different from the pigments of US 4,597,949 in physical and, perhaps more importantly, coloristic properties.

In the declaration, a pigment with the chemical structure according to instant example 1b



was prepared by the method of US 4,597,949, example 48, substituting p-phenylthio-benzonitrile for benzonitrile - Sample A; and by the method according to instant example 1b - Sample B.

The transmission electron microscopy photos at the bottom of page 2 in the declaration show the differences in particle size between the two samples.

The table on page 3 shows the difference in color strength, saturation, hue and transparency between the two samples after incorporation into PVC.

The transmission spectra of the PVC samples are shown on page 4.

The table in the middle of page 4 shows the color space data of color filters prepared using each of the two pigment samples.

It is clearly shown that the process of the instant application, Sample B, directly yields pigment particle sizes of less than $0.1\mu\text{m}$ while the process of US 4,597,949, Sample A, yields much larger particles. The colors of the pigments was quantitatively measured two different ways and clearly show a difference in color space with Sample B prepared according to the instant invention demonstrating higher color strength, higher color saturation, a measurably more bluish hue and a much higher contrast ratio. Inventive Sample B is also shown to have a transmission at 570-580 nm of less than 5% and a transmission at 615 nm of at least 80%, whereas Sample A prepared by the process of US 4,597,949 fails to meet this important standard for color filters.

The two processes clearly yield two different pigments.

It may be possible to further process Sample A, prepared by the process of US 4,597,949, to reduce the pigment size and coloristic properties. However, this is not a given. Particle sizes of less than $0.1\mu\text{m}$ are difficult to obtain, especially with DPPs. Very small particles are even known to grow under extremely hash milling conditions, such as salt kneading, due to Ostwald ripening, see for example US 6,517,630. Nonetheless, even if the pigment of US 4,597,949 could be transformed into the pigment of the instant invention, the instant process yields the desired pigment particle directly by using a relatively simple, inventive hydrolysis step, which step, or the benefits of the inventive step, are not disclosed or suggested in US 4,597,949.

Even without considering the evidence of the declaration, Applicants respectfully submit that the instant claims are allowable over US 4,597,949 as the process for preparing the pigments, wherein the reaction mixture is discharged into a mixture comprising methanol and acetic acid at a temperature below 30°C is not disclosed and which process results in a pigment not contemplated by US 4,597,949 having a particle size of less than or equal to 0.1µm, a transmission at 570-580 nm of less than 5% and a transmission at 615 nm of at least 80%.

It is well known that the chemical formula of pigment molecules is only one structural component to be considered and particle size, size distribution, crystal phase, morphology and aggregation all play a role in determining transparency and hue. The Examiner makes the logical assertion that it would be obvious for one to formulate specific sizes of particulate matter from the process of Rochat. Applicants however, respectfully suggest that there are innumerable ways one might consider for altering the process of Rochat, and nothing in Rochat would guide one to the invention whereby the particle size could be so dramatically affected by the specific features of the process of claim 4.

Applicants further note that US 4,597,949 only very generically suggests chemical structures related to those of instant Formula I. None are explicitly described, named or exemplified in any way.

While it may be possible to further process pigments of US 4,597,949 to the a particle size of 0.1µm or less, given the difficulties in many of the known processes for obtaining such small particle sizes alluded to above, it is by no means known whether existing methods would be able to provide such pigments. Applicants also respectfully suggest that given the broad, generic disclosure of US 4,597,949, even reducing the particle size of the pigments fully described therein would still not provide the pigments of the instant claims. Finally, Applicants have seen no reports in the art of the specific pigments of the instant invention with the instantly disclosed combination of chemical structure, particle size and coloristic properties.

In considering Wallquist US 4,597,949, it must be noted that Wallquist controls the particle size of pigment particles by incorporating crystal growth inhibitors, see for example column 1 lines 6-10. This is a different approach to solving the problem of obtaining small particle pigments and results, as discussed in previous responses, in a chemically and coloristically different pigment than that required in the instant invention.

Applicants therefore respectfully submit that, in light of the amendments and discussion above, the process of instant claim 4 is not arrived at by combining US 4,597,949 and US Pat 5,738,719 and that the pigments of the instant invention are not those of either patent and are not obtained by practicing the teachings of the combined art. Applicants again note that US 4,597,949 only very generically suggests chemical structures related to those of instant Formula I and does not fully describe, name or exemplify them in any way.

Applicants therefore respectfully request the Examiner withdraw the 103(a) over Rochat US 4,597,949 in view of Wallquist, US Pat 5,738,719 rejections of claims 1-10 and 12-14.

Claims 1-10 and 12-14 are rejected under 35 USC 103(a) as obvious over Rochat US 4,597,949 in view of WO 02/10288. WO 02/10288 discloses the use of DPPs in color filters.

Applicants respectfully traverse the rejections.

As disclosed in the specification (see for example the end of page 2), color filters have specific requirements that are not met by existing DPPs and fine-sized diketopyrrolopyrroles presently used in color filters (for example Irgazin[®] DPP Red B-CF = Colour Index Pigment Red 254) fail to fulfill the instant color requirements. This would also be the case of coarse particle size pigments of instant formula (1). Instant figure 1 shows a very steep increase in transmission at about 600nm of the instant pigments, which Applicants respectfully aver could not be expected from the prior art.

While WO 02/10288 discloses the use of DPPs in color filters, it does not disclose the use or value of the particular DPPs of the instant invention in color filters. As Applicants described above, US 4,597,949 also does not disclose the instant pigments. Therefore, Applicants respectfully submit that combining the pigments of Rochat, which are not the pigments of the instant invention, with the disclosure of WO 02/10288 does not meet the limitations of the instant claims.

Applicants therefore respectfully request that the rejections of claims 1-10 and 12-14 under 35 USC 103(a) over or Rochat US 4,597,949 in view of WO 02/10288 be withdrawn.

In summary, Applicants respectfully maintain that pigments with the combined elements of chemical structure, particle size and coloristic properties of the instant invention are not known and have not previously been prepared or adequately described.

Applicants respectfully maintain that compounds of instant formula 1 are only very generically described in US 4,597,949 and there is no teaching in US 4,597,949 that leads one to the particular size and transparency of the instant pigments or a process for preparing them. The disclosure of WO 02/10288 fails to overcome these deficiencies.

The pigments of US Pat 5,738,719 are different chemically and coloristically. The method for controlling particle size is also different than the instant process.

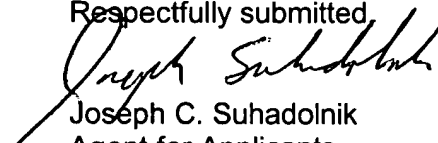
Applicants also wish to respectfully state that while the phrase "blue tinged red shade" may ambiguous and not needed here as a claim element, the specific color of a pigment is a real property and is due to more than chemical structure. Applicants suggest that the spectral limitations of the instant claims along with the discussion of color requirements found in the specification do have real meaning to the practitioner and do on a practical level differentiate the instant pigments from the red orange, claret, reddish violet or violet pigments described in the cited art.

Regardless of this issue of color definition, Applicants respectfully submit that the above amendments and discussion address and overcome all rejections.

The Examiner is therefore respectfully requested to withdraw the rejections and kindly find claims 1-10 and 12-14 allowable. In the event that minor amendments will further prosecution, Applicants request that the examiner contact the undersigned representative.

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